REMARKS

1. Claim 1 has been amended to recite "wherein both syngas and said exhaust are simultaneously provided to said filter" based on claim 10. Accordingly, claim 10 has been canceled. Claim 11 has been amended to correct the claim dependency.

2. In the Office Action, Claim 1 was rejected under 35 USC 103(a) as being unpatentable over Maunula US 2002/0054843 (hereinafter "Maunula") in view of Buchanan et al. US 5,591,417 (hereinafter "Buchanan"). As noted in previous responses, there is no teaching or suggestion in the Buchanan reference of using syngas to regenerate a NO_x adsorbing material used to treat the exhaust from an internal combustion engine. With respect to the reduction of nitrogen oxide, the focus in Buchanan is to reduce the amount of nitrogen oxide formed during combustion in the combustor. Neither the Buchanan reference or the Maunula reference provide any reason as to why the skilled person would use the reducing gas (e.g., syngas) of Buchanan, which is used to regenerate the solid sulfur oxide sorbent, in the system of Maunula, which regenerates the NO_x adsorption catalyst through the use of a lean-rich (air/fuel) mixture combination in the engine.

Further, Maunula does not teach or suggest a porous, interdigitated ceramic filter including a plurality of inlet channels and a plurality of outlet channels contiguous with said inlet channels and simultaneously providing both syngas and exhaust gas to the filter so that within the filter NO_x and particulates are being reduced in the exhaust gas and the NO_x adsorbing material is being regenerated and the trapped particulates are being catalytically burned. The Maunula reference merely teaches periodic regeneration by changing the process conditions (e.g., feedstream content) experienced by the whole operational unit (e.g., NO_x adsorber or particle separator). The Buchanan reference also merely discloses periodic regeneration by changing the content of the feedstream to the whole solid sulfur oxide sorbent bed.

Advantages of the present invention include removing oxides of nitrogen and sulfur from internal combustion engine exhaust with a minimum usage of syngas and providing effective and efficient removal of oxides of nitrogen, sulfur and particulates from the exhaust. These advantages result from the discovery that the use of syngas for regeneration of NO_x adsorbent material can also accommodate the utilization of syngas for catalytic burning of particulates in a filter. Also, use of a porous interdigitated ceramic filter having outlet channels contiguous with inlet channels allows for mixing of the exhaust gas and syngas in

the outflow interdigitated channels which are at the gas interface of the inlet for the exhaust gas and the inlet for the syngas. This mixing of the exhaust gas with highly concentrated syngas in the presence of catalytic combustion can produce a higher temperature at the point of mixing within the channels, sufficient to decompose the sulfur compounds trapped by the NO_x adsorbing material which results in improved regeneration. *See Application text, as filed*, page 5, lines 2 – page 6, line 9; page 11, line 20 – page 12, line 18. This is an unexpected advantage over the cited references.

Regarding the regeneration of the NO_x adsorber, the Maunula reference teaches to remove nitrogen oxides and sulfates from the NO_x adsorber with a lean-rich mixture sequence. *See U.S. Patent Application Publication No.* 2002/0054843, page 2, paragraph 21; page 2-3, paragraph 27. Regarding the regeneration of the particle separator, the Maunula reference teaches to remove the soot by using different process conditions such as a high NO_2/C ratio in the feedstream or even thermal combustion with oxygen to remove the soot. *See Id.* at page 3, paragraph 40; page 4, paragraphs 44-46. The Buchanan reference is silent regarding the regeneration of a NO_x adsorbent as well as the regeneration of a particulate trap. Neither Maunula nor Buchanan provide any reasoning such that the skilled person would combine the Maunula and Buchanan references to arrive at the present invention, in particular to use a porous interdigitated ceramic filter having outlet channels contiguous with inlet channels and containing both a NO_x adsorbent material and a NO_x reduction catalyst while simultaneously providing exhaust gas for removal of NO_x and particulates and syngas for regenerating the NO_x adsorbing material and catalytically burning particulates trapped in the filter. Accordingly, Applicants submit that the claims are patentable over the cited references.

CONCLUSION

Allowance of the claims of the present application is respectfully requested. Should any fee be due in connection with the filing of this document, the Commissioner for Patents is hereby authorized to deduct said fee from Shell Oil Company, Deposit Account No. 19-1800. Should the Examiner find any impediment to the prompt allowance of the claims which could

be corrected by telephone interview with Applicant's representative, the Examiner is requested to initiate such an interview with the undersigned.

Respectfully submitted,

KE LIU, WAYNE G. WNUCK, and
JOHN G. BUGLASS

_____/Lisa K. Holthus/_____
Attorney, Lisa K. Holthus
Registration No. 60,082
(713) 241-5192

P.O. Box 2463
Houston, Texas 77252-2463